

The Value of Innovation to Implementation Program (VI²P): A strategic approach to aligning and leveraging academic research and clinical care missions

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Abstract

Problem: Inefficient implementation of evidence-based care garners increasing attention as a source of suboptimal value of clinical care, and integration of quality improvement methodology into clinical practice represents a potential solution. Academic medical centers (AMCs) often have expertise in implementation science, yet it is not leveraged effectively to solve operational inefficiencies or to rapidly implement evidence-based practices (EBPs).

Approach: To leverage in-house research expertise, the University of Kentucky (UK) College of Medicine and Center for Health Services Research (CHSR) launched a pilot awards program—Value of Innovation to Implementation Program (VI²P)—across its health system and six health professional colleges. Criteria for awards included a transdisciplinary research team and addressing health disparity issues faced by Kentucky. Outcome measures included EBP adoption and implementation and future funding.

Outcomes: The VI²P produced 26 transdisciplinary teams that submitted letters of intent. Ten teams were invited to submit full proposal, and four projects were selected for award, spanning the entire continuum of health-impact research. Three nonawarded projects were implemented and prompted system redesign for an “implementation research living laboratory.” A Workgroup for Implementation Science (WINS) was established to forge transdisciplinary teams to pursue federal grant funding yielding proposals totaling \$17.17 million submitted, \$4.38 million awarded, and \$5.97 million under review. Junior faculty were encouraged to pursue implementation science as a research focus.

Next Steps: UK WINS will continue serve as the hub for dissemination and implementation researchers at UK. On the basis of the enthusiasm expressed by multiple groups and many inquiries about the future training opportunities at UK, we plan to develop a tailored dissemination and implementation (D&I) training program to build research and practice capacity at UK.

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KEYWORDS

evidence-based practice, implementation science, transdisciplinary team

1 | PROBLEM

“Medical care must be provided with the utmost efficiency. To do less is a disservice to those we treat, and an injustice to those we might have treated.”

William Osler

One of the most critical issues impeding delivery of high-value care is the enormous gap between evidence-based practices (EBPs) and the implementation of such practices to optimize health care.¹⁻³ Many factors can impede EBP uptake, including competing demands on frontline providers; lack of knowledge, skills, and resources; and misalignment of research evidence with operational priorities. Dissemination science, improvement science (ie, quality improvement, QI) and implementation science are becoming growing focused areas in addressing complex systems issues related to patient care and population health. Dissemination science studies the spread, uptake, and utilization of an intervention, assisted at most by educational communication efforts.⁴ The concept of improvement science emerged to provide a framework for research focused on health-care improvement, with the primary goal to determine which improvement strategies work as striving to assure effective and safe patient care.⁵ Implementation science (IS) is the scientific study of methods to promote the systematic uptake of research findings and other EBPs into routine practice and, hence, to improve the quality and effectiveness of health services.⁶ There is overlap among approaches because dissemination is typically embedded in more comprehensive, targeted, and active efforts to spread EBPs, while implementation efforts often incorporate dissemination techniques. Although, there are some differences in QI and IS, for example, QI begins with a local problem and lead to improve a specific problem for a specific health system, while IS begins with an underutilized EBP and lead to address quality gaps at multilevel and develop generalizable knowledge. Nonetheless, methods (eg, systems science, behavioral theory, and organizational theory) used in QI and IS often overlap. Increased efforts to apply such research methodologies into practice settings will be important to best optimize practice efficiency and quality.

As noted in the Institute of Medicine report, *Demanding Value from Our Health Care* (2012), the largest inefficiencies in health-care result from lack of uptake or implementation of known beneficial therapies or use of unnecessary or non-evidence-based services that do not improve outcome but come with associated risk and cost.⁷ Academic medical centers (AMCs) often have expertise and capacity of transdisciplinary research teams required by IS, including members who are not routinely part of most clinical trials, such as health services researchers, economists, sociologists, anthropologists, organizational scientists, and operational partners—administrators, front-line

clinicians, and patients. The typical characteristics of AMCs, such as patient population size and diversity, extensive data collection capabilities (eg, enterprise data warehouses), research and quality infrastructure, heterogeneity of affiliates and partners, and community outreach make AMCs useful systems in which to carry out implementation research. However, the implementation research expertise at AMCs has not been effectively leveraged to solve problems of clinical inefficiencies within the clinical operations of large health systems.⁸ Currently, multiple organizations are making efforts and/or seeking approaches to implement evidence-based protocols more effectively using scientifically rigorous methods.⁹

Over the past 15 years, the field of IS has experienced an “explosion” of progress in both quality and quantity, as illustrated by the proliferation of frameworks and models, a climbing number of empirical studies, and dedicated federal funding for Dissemination and Implementation (D&I) Research in Health.¹⁰ Compounding national concerns over the cost of health care, our AMC also faces, in the Commonwealth of Kentucky, the highest cancer mortality in the nation and high incidence of stroke, diabetes, obesity, substance use disorder, and chronic respiratory disease.^{11,12} Thus, efforts to increase health-care value are critically important to our citizens' future.

2 | APPROACH

In response to the pressing needs of an expanded and broadly supported capacity for implementation research and scientific-supported implementation strategies to promote more rapid uptake of effective practices, in January 2017, the University of Kentucky (UK) College of Medicine (COM), the Center for Health Services Research (CHSR), and the UK HealthCare Clinical Operations Team launched the Value of Innovation to Implementation Program (VI²P) with a request for applications (RFA) for new pilot projects. This campus-wide effort was led by the COM Dean and the CHSR Director, with support from the University Vice President for Research and the leadership from UK HealthCare represented by the Chief Information Officer. As a pilot program, VI²P aimed to

1. transform UK HealthCare and affiliates into a “living laboratory” to adopt, adapt, and implement new knowledge and evidence-based practices;
2. foster a learning collaborative/network of implementation researchers and practitioners to forge a transdisciplinary understanding of the methodological issues and conceptual challenges required for external D&I research grants; and
3. identify educational needs and develop strategies to build internal D&I capacity including infrastructure for the requisite work (eg,

methods, technical support, and coordinating capacities), information networks, and workforce.

The VI²P requested applications for studies to support innovative, collaborative research projects that would identify, develop, test, and evaluate strategies to disseminate and implement EBPs into public health, clinical practice, and community settings; to advance D&I research methods and measures; or to deimplement clinical or community practices that are wasteful or not evidence-based but widely adopted. Leadership prioritized projects with a transdisciplinary team of scientists, clinicians, practice and/or community stakeholders, and process improvement experts (Team Science), and targeted issues relevant to the health disparities in Kentucky.

Individual project awards were limited to \$110 000 in total direct costs over an 18-month period. All interested VI²P applicants who would serve as principal investigator (PI) or co-PI, if they had not conducted any focused D&I projects, were required to attend a 2-hour training workshop on D&I research to build participants' basic knowledge of the terminology and principles for when the subsequently communicated with a D&I expert on study design and outcomes. All proposals were required inclusion of a D&I model/framework to guide the study design, outcomes selection, and evaluation. The study teams were also encouraged to include implementation outcomes in addition to health outcomes. IS experts from the UK CHSR provided consultations and addressed more complex issues of D&I study designs, theoretical and conceptual models, and the development and measure of D&I strategies. All applications were subject to a standard National Institutes of Health (NIH)-type study section assessment and were scored based upon written reviews, relevance to NIH scientific and technical merit, and VI²P priority criteria. Specific criteria for selection included (a) the likelihood that funding will result in submission of a competitive application for extramural funding; (b) projects with a clear plan toward future federal funding grant submissions; (c) clear description of feasibility and sustainability of implementation; (d) inclusion of students, residents, and/or fellows; and (e) relevance to the health challenges and disparities faced by the citizens of Kentucky.

Implementation expertise at UK was identified through a "snowball" methodology approach and an informal network of researchers was established with a common interest in D&I science. This included faculty from a variety of settings and sectors (e.g., health system, mental health services, public health, health services, behavioral intervention, health economics, substance use disorder, autism, acute care, cancer). We invited implementation researchers lacking interest in submitting applications to VI²P to participate on the VI²P Review Committee.

3 | OUTCOMES

There were 107 participants who attended one of two 2-hour D&I research training workshops. Interested teams typically met with consultants from the CHSR for 1 to 2 hours. The initial meeting often

yielded the consultant being asked to participate on the project proposal as a co-PI or co-I. The majority of questions asked related to study design, D&I model and framework selection, and study outcomes. Each CHSR D&I expert received more than one request to serve as either co-PI or co-I for different teams. On the basis of this larger than expected interest, we identified additional researchers in other Colleges at UK who possessed D&I expertise and successfully engaged them in helping teams applying for the program.

The VI²P RFA process resulted in the formation of 26 transdisciplinary teams that submitted the two-page letter of intent (Table 1). Teams formed included an average number of 5 investigators (range 2 to 14) from an average number of three departments (range 1 to 6) and two health professions colleges (range 1 to 4). As a measure of interest in improving a particular clinical setting, projects were planned in hospital-based (54%), practice-based (54%), or community-based (27%) settings, respectively. Five of 26 proposed studies aimed to address quality measures that are either public reported measures from the Center for Medicare and Medicaid Services (CMS) or endorsed by Agency on Health Research and Quality (AHRQ), and fifteen of 26 proposed studies aimed to address the implementation of evidence-based practices. Of the hospital-based teams, two focused on medication prescribing practices and three targeted practices in the emergency room and intensive care setting. Overall, seven concentrated on improving implementation of diagnostic technologies; and five addressed issues or medical complications related to drug addiction and/or abuse.

The review committee provided information on other potential internal and external funding opportunities to the 11 proposals that were deemed not to be D&I studies after review. Ten out of the 15 proposed D&I studies were invited to submit full proposal, following the NIH R21 requirements. Through the two-step review process (two-page letter of intent followed by invitation to submit a R21 format full proposal), four studies were selected for award in July 2017, with PIs from Colleges of Medicine, Nursing, Public Health, and Pharmacy (Table 2). These projects span the entire continuum of health-impact research, from behavioral interventions, health system strengthening to improve outcomes, prevention, early detection, diagnosis, to disease treatment and management. As of 1 year into the projects, eight conference abstracts and two manuscripts were submitted by these four teams.

3.1 | Implementation research living laboratory

Although not selected for award, three teams receiving a full proposal invitation kept refining their projects and eventually initiated implementation at UK HealthCare and affiliates, thus fostering a platform for an "Implementation Research Living Laboratory." Projects include *Implementing emergency department hepatitis C (HCV) screening with linkage to care*; *Implementation of two novel transdisciplinary care models and the impact on hepatitis C treatment uptake* and *Implementation of a transvaginal ultrasound surveillance program in women in Appalachian Kentucky with a history of previous preterm birth*. These implementations have prompted care redesign and contributed to

TABLE 1 Value of innovation to implementation program (V²P) teams

Project title	Number per team	Number of Departments/Colleges	Hospital Ops Setting (Y/N)	Practice-Based Setting (Y/N)	Community Setting (Y/N)	Workshop (Y/N)	Quality (Y/N)	Dissemination and Implementation (D&I) (Y/N)
Tobacco use in pregnancy intervention for cessation (ToPIC)	6	6/4	N	Y	Y	Y	N	Y
An evidence-based algorithm to decrease the use of opioids for patients with Crohn's disease in the emergency department	4	4/3	Y	N	N	Y	N	Y
Supporting caregivers in feeding preterm infants: Evidence-based strategies for improved outcomes	5	2/4	Y	N	N	Y	N	Y
Improvement of care for patients with cirrhosis and recurrent/refractory ascites by use of Transjugular intrahepatic portosystemic shunts (TIPS) with covered stents	3	3/1	Y	Y	N	Y	N	N
Disseminating evidence-based practices for promoting breastfeeding in Appalachian Kentucky	3	2/2	N	Y	Y	Y	N	Y
Implementation of diagnostic management teams to direct optimal evidence-based test ordering and interpretation	7	4/3	Y	N	N	Y	N	Y
Preoperative nutritional assessment and intervention in patients with muscle-invasive bladder cancer: A multidisciplinary approach to improving outcomes and decreasing costs in patients undergoing radical cystectomy	2	2/1	Y	N	N	Y	N	N
Partnership for identification and primary-care based enrollment to a prevention intervention for diabetes (PIPE to prevent diabetes)	7	4/2	N	Y	N	Y	N	N
Implementing oncology precision medicine in Kentucky	7	4/3	N	Y	N	Y	N	Y
Latexin as a target for pharmaceutical intervention	5	2/1	Y	N	N	Y	N	Y

(Continues)

TABLE 1 (Continued)

Project title	Number per team	Number of Departments/Colleges	Hospital Ops Setting (Y/N)	Practice-Based Setting (Y/N)	Community Setting (Y/N)	Workshop (Y/N)	Quality (Y/N)	Dissemination and Implementation (D&I) (Y/N)
Implementing emergency department hepatitis C screening with linkage to care	4	3/1	Y	Y	N	Y	N	Y
Patient preferences regarding trainee involvement in medical care before and after an education intervention	2	1/1	Y	Y	N	Y	N	N
Implementation of a delirium treatment bundle in adult intensive care patients: a prospective observational cohort study using the collaborative model for knowledge translation between research and practice settings.	7	4/2	Y	Y	N	Y	Y	Y
Examining bone biomarkers and histology in experimental and human AKI	4	2/1	Y	N	N	Y	N	N
Assessment of clinician barriers in individualizing patient care	5	3/2	N	N	Y	Y	N	N
Inferior vena cava filter retrieval E-notification system (IVC-FRENS)	10	5/2	N	Y	N	Y	N	N
Implementation of two novel transdisciplinary care models and the impact on hepatitis C treatment uptake	3	3/1	N	Y	Y	Y	N	Y
Implementation and dissemination studies for best-practices in perinatal medicine: Evidence-based treatment for improving neonatal abstinence syndrome outcomes	5	2/1	Y	N	N	Y	Y	Y
Adaptation and pilot implementation of the family check-up for deaf and hard of hearing children	6	5/4	N	Y	N	Y	N	Y
Implementation of a transvaginal ultrasound surveillance program in women with a history of previous preterm birth: Disseminating evidence-based practices for reducing preterm birth in Appalachian Kentucky	2	1/1	Y	Y	N	Y	N	N

(Continues)

TABLE 1 (Continued)

Project title	Number per team	Number of Departments/Colleges	Hospital Ops Setting (Y/N)	Practice-Based Setting (Y/N)	Community Setting (Y/N)	Workshop (Y/N)	Quality (Y/N)	Dissemination and Implementation (D&I) (Y/N)
Implementation and dissemination studies for best- practices in perinatal medicine: Delaying umbilical cord clamp (DCC) for improved infant outcomes in Kentucky	5	2/1	N	N	Y	Y	Y	Y
Evaluation of the feasibility and acceptability of implementing an evidence-based mindfulness curriculum in a high school setting for high-risk youth, and effects on student's depression, anxiety, anger, and resilience	7	5/4	N	N	Y	Y	N	N
Closing the gap and streamlining best practices: A DI approach to point of care pharmacotherapy	3	3/1	N	N	Y	Y	N	Y
Effects of lumbar fusion surgery on lumbo-pelvic rhythm	2	2/2	N	Y	N	Y	N	N
Improving medication reconciliation practices at admission, discharge and communication between inpatient and outpatient services	2	2/2	Y	Y	N	Y	Y	N
UK-CECT: Multidisciplinary study of contrast enhanced computed tomography evidence-based practice	14	4/2	Y	N	N	Y	Y	Y

TABLE 2 Value of Innovation to Implementation Program (VI²P) awarded projects

Project title	Project Aims	PI Affiliation
Tobacco use in pregnancy intervention for cessation (ToPIC)	<p><i>Aim 1.</i> To determine the impact of ToPIC on maternal and infant health outcomes compared with baseline and compared with patients receiving usual care at a control clinic. Key indicators will include</p> <ol style="list-style-type: none"> 1. Maternal tobacco use including (a) increased rates of smoking cessation (self-report and validated); (b) decreased number of cigarettes smoked per day; (c) decreased rates of relapse (self-report and validated) 2. Maternal health outcomes including (a) higher compliance with prenatal care and (b) fewer preterm deliveries 3. Infant health outcomes including (a) reduced incidence of low birth weight; (b) fewer sick encounters through 6 months of age; and (c) higher compliance with well-baby visits <p><i>Aim 2.</i> To measure implementation effectiveness of ToPIC in the participating clinic through assessment of the following:</p> <ol style="list-style-type: none"> 1. Facilitators and barriers to intervention delivery; 2. Fidelity of implementation; 3. Identification of strategies to maximize the facilitators and overcome implementation barriers; and 4. Identification of potential modifications that could be made to maximize intervention delivery and ultimately efficacy. 	College of Nursing
Partnership for Identification and Primary-care based enrollment to a prevention intervention for diabetes (PIPE to prevent diabetes)	<p><i>Aim 1.</i> Increase the rates of diabetes screening and recognition of prediabetes in adult patients cared for by University of Kentucky (UK) family medicine.</p> <p><i>Aim 2.</i> Assess the comparative effectiveness of standard care (provider-initiated) versus the addition of a population health/case-management approach for the referral and enrollment of prediabetic patients in the UK diabetes prevention program (DPP).</p> <p><i>Aim 3.</i> Evaluate the implementation processes that result in the successful referral and retention of patients into the UK DPP using mixed-method approaches targeting patient, provider, and system factors.</p>	College of Medicine
	<p><i>Aim 1.</i> To refine the molecular tumor board (MTB) + precision medicine toolkit (PMT) implementation strategy based upon perspectives of stakeholders across Kentucky regarding use of evidence-based cancer precision medicine (CPM).</p> <p><i>Aim 2.</i> To pilot-test the provider-informed MTB + PMT implementation strategy with two community oncology practices, assessing feasibility, acceptability, and preliminary provider- and practice-level outcomes. Measures of factors that may influence implementation outcomes will also be piloted in preparation for a larger state-wide trial.</p>	College of Pharmacy/Markey Cancer Center
Adaptation and pilot implementation of the family check-up for deaf and hard of hearing children	<p><i>Aim 1.</i> To expand upon our existing partnership with the Kentucky Commission for Children with special healthcare needs (CCSHN) by convening a community advisory board (CAB) comprising CCSHN staff, parents of DHH children, and hearing healthcare providers.</p>	College of Public Health

(Continues)

TABLE 2 (Continued)

Project title	Project Aims	PI Affiliation
	<p><i>Aim 2.</i> To systematically adapt the evidence-based family check-up (FCU) behavioral parent training (BPT) by incorporating the preferences and perspectives of our CAB; experts in pediatric hearing loss, language development, and BPT; and parents and providers engaging in key informant interviews and focus groups.</p> <p><i>Aim 3.</i> To pilot the adapted FCU for parents of deaf and hard of hearing children (FCU-DHH) in 2 CCSHN clinics, appraising protocol details for our future R01 hybrid effectiveness-implementation trial and assessing feasibility, acceptability, and costs. Measures of implementation constructs from the consolidated framework for implementation research (CFIR)¹⁷ will also be piloted in preparation for the R01 submission.</p>	

BPT, behavioral parent training.

new infrastructure that stimulates the adoption of EBPs by end users and leverages the care provided through clinical and community delivery. Examples of care redesign included geographic cohorting of patients and clinician teams or direct gastrointestinal (GI) specialist referral from the Emergency department (ED) for hepatitis C virus (HCV) positive patients. Examples of infrastructure development include telemedicine for the care of HCV patients in rural area and a built-in alert for pre-diabetes screening. In 18 months of VI²P launching, the two hepatitis C projects received industry funding and the preterm birth project received a Clinical and Translational Science Awards (CTSA) Community Engagement pilot award.

3.2 | A learning collaborative/network

The VI²P review sessions served as an unofficial kick-off of events to exchange and synthesize information and share experiences among implementation researchers at UK in order to learn about new resources for D&I research to plan joint projects and foster professional development. Using this platform, a Workgroup for Implementation Science (WINS) has established with defined vision and areas

TABLE 3 University of Kentucky Workgroup for Implementation Science (UK WINS) vision and areas of focus

Vision
Establish UK a leader in implementation science to promote innovative research, bridge the gap between evidence and practice, and address complex health issues.
Areas of focus
<ul style="list-style-type: none"> • Create and support an internal UK community around implementation science • Enhance the capability of UK investigators to secure dissemination and implementation science funding and training opportunities from NIH and other sources • Apply learning health system concept and use UK HealthCare and affiliates as a laboratory to study D&I methods and interventions in order to advance research and optimize patient care

of focus (Table 3). The group meets bimonthly to coordinate and foster collaboration, funding, training, and mentor/mentee opportunities and offer a supportive, transdisciplinary opportunity for interactive conversation and feedback regarding specific projects. Members represent diverse research areas across UK with a common interest in D&I science in health. Another key activity is reviewing new funding opportunities and forging transdisciplinary teams to pursue extramural funding. The group has developed a database of faculty expertise in domains of D&I research so members can easily identify potential collaborators. Moreover, the establishment of WINS at our AMC serves as a support hub for development of transdisciplinary teams to pursue federal and other grant funding in D&I research. Since the launch of VI²P in January 2017, the UK researchers have submitted \$17.17 million in D&I research proposals to the NIH and received \$4.38 million in awards. Currently two R01 proposals (\$5.97 million) are under review.

3.3 | Build D&I capacity

The feedback on VI²P training sessions, and technical and coordination support features, provided data that guide the development of strategies and workforce training programs to build local D&I research capacity. Training investigators for the rapidly developing field of implementation science also requires both mentoring and scientific collaboration. The CHSR serves as a hub to provide D&I training through visiting professor sessions, presentations at grand rounds, and other guest lectures. WINS compiled available training programs and distributed to all interested researchers through the CHSR website and listserv. Notably, two UK faculty were selected to participate in the Training in Dissemination and Implementation Research in Health (TIDIRH), a NIH-funded training program. Mid-career faculty commented that they feel more connected to their colleagues and were encouraged to initiate implementation projects and proposals with the access to the actual environments of end users across the health continuum. Two junior clinical faculty have decided to pursue D&I research in their career and combined received a CTSA pilot award,

CTSA cross-institute pilot award, and CTSA Mentored Career Development Awards (KL2) scholarship.

4 | NEXT STEPS

VI²P demonstrated the institution's support for D&I research at UK and increased the implementation of EBP and high value care in daily practice. UK WINS will continue to serve as the hub for all D&I researchers at UK. On the basis of the enthusiasm expressed by multiple groups and many inquiries about the possibility of future training opportunities at UK, we plan to develop a tailored D&I training program to build research and practice capacity at UK through several activities: (a) administer a campus-wide D&I research training needs assessment to identify the most desired and needed knowledge and skills; (b) develop a graduate level IS course curricula; (c) design a half-day workshop or breakout session that could be tacked on to an existing event at UK such as CTSA Spring Conference, Vice President for Research workshop series, and CHSR Retreat; and (d) establish an IS Visiting Professor Series that could be independent or integrated with several existing seminars as a featured session.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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